Claims

1. (Currently Amended) A method of making an ester comprising:

(a) contacting an olefin selected from the group consisting of ethylene, propylene, isoolefins, normal butenes, and C_5 to C_{18} olefins with carbon monoxide and a $BF_3$2ROH acid ~~compositon~~ composition to form a product composition;

(b) adding ROH to the product composition of (a); and

(c) separating a $BF_3$2ROH acid product from the ester, wherein ROH is selected from methanol; n-propanol; n-butanol; 2-propanol 2-ethyl hexanol; isohexanol; isoheptanol; isooctanol; isononanol; 3,5,5-trimethyl hexanol; isodecanol; isotridecanol; 1-octanol; 1-decanol; 1-dodecanol; 1-tetradecanol and mixtures thereof.

2. (Previously Presented) The method of claim 1 further comprising recycling a portion of the separated acid product to contact the olefin.

3. (Previously Presented) The method of claim 1 wherein the olefin is an isoolefin.

4. (Original) The method of claim 2 wherein the olefin is isobutene.

5. (Cancelled)

6. (Cancelled)

7. (Previously Presented) The method of claim 1 wherein the olefin is contacted with carbon monoxide and a $BF_3$2ROH acid composition at a temperature from about 60°C to about 200°C.

8. (Previously Presented) The method of claim 7 wherein said temperature is from about 110°C to about 160°C.

9. (Previously Presented) The method of claim 1 wherein the olefin is contacted with carbon monoxide and a $BF_3$2ROH acid composition at a pressure from about 30 atm to about 200 atm.

10. (Previously Presented) The method of claim 9 wherein said pressure is from about 110 atm to about 160 atm.

11. (Cancelled)

12. (Original) The method of claim 1 wherein ROH is methanol.

13. (Cancelled)

14. (Cancelled)

15. (Previously Presented) The method of claim 1 further comprising contacting the olefin with a saturated linear or branched hydrocarbon having at least six carbons.

16. (Previously Presented) The method of claim 1 further comprising adding to the product composition a saturated linear or branched hydrocarbon having at least six carbons.

17. (Previously Presented) The method of claim 16 further comprising separating the hydrocarbon and ROH from $BF_3$2ROH and directing a portion of the separated hydrocarbon and the separated ROH to a unit selected from the group consisting of a separation unit, a reaction unit, and a combination thereof.

18. (Previously Presented) The method of claim 1 further comprising contacting the olefin with phosphoric acid.

19. (Previously Presented) The method of claim 1 wherein the acid product is separated by concentrating the acid product such that the molar ratio ROH:BF_3 in the concentrated acid product is from about 2:1 to about 4:1.

20. (Previously Presented) The method of claim 19 wherein said molar ratio of ROH:BF_3 is from about 2:1 to about 3:1.

21. (Previously Presented) The method of claim 1 wherein the acid composition has a molar ratio of ROH:BF_3 from about 1.6:1 to about 3: 1.

22. (Previously Presented) The method of claim 21 wherein said molar ratio is from about 1.9:1 to about 3: 1.

23. (Previously Presented) The method of claim 1 wherein the product composition contains less than 3% by weight carboxylic acid.

24. (Previously Presented) A method of making methyl pivalate comprising:

contacting methyl-t-butylether with carbon monoxide and a BF_32CH_3OH acid composition to form a methyl pivalate product composition

adding methanol to the product composition; and

separating a BF_32CH_3OH acid product from the methyl pivalate.

25. (Previously Presented) The method of claim 24 wherein the methyl-t-butylether is contacted with carbon monoxide and a BF_32CH_3OH acid composition at a temperature of about 110°C to about 160°C.

26. (Previously Presented) The method of claim 24 wherein the methyl-t-butylether is contacted with carbon monoxide and a BF_32CH_3OH acid composition at a pressure from about 30 atm to about 200 atm.

27. (Previously Presented) The method of claim 24 further comprising contacting the methyl-t-butylether with a saturated linear or branched hydrocarbon having at least six carbons.

28. (Previously Presented) The method of claim 24 further comprising contacting the product composition with a saturated linear or branched hydrocarbon having at least six carbons.

29. (Original) The method of claim 28 further comprising separating the hydrocarbon and the methanol from the methyl pivalate and directing a portion of the separated hydrocarbon and the separated methanol to a unit selected from the group consisting of a separation unit, a reaction unit, and a combination thereof.

30. (Original) The method of claim 24 further comprising contacting the methyl-t-butylether with phosphoric acid.

31. (Previously Presented) The method of claim 24 wherein the acid product is separated by concentrating the acid product such that the molar ratio ROH:BF_3 in the acid product is from about 2:1 to about 4:1.

32. (Previously Presented) The method of claim 31 wherein said molar ratio of ROH:BF_3 is from about 2:1 to about 3:1.

33. (Previously Presented) The method of claim 24 wherein the acid composition has a molar ratio of ROH:BF_3 from about 1.6:1 to about 3: 1.

34. (Previously Presented) The method of claim 33 wherein said molar ratio is from about 1.9:1 to about 3: 1.

35. (Original) The method of claim 24 wherein the product composition contains nonanoic methyl esters such that the molar ratio of methyl pivalate to nonanoic methyl esters is about 4 or greater.

36. (Previously Presented) A method of making an ester comprising:

(a) contacting an olefin selected from the group consisting of ethylene, propylene, isoolefins, normal butenes, and C_5 to C_{18} olefins with carbon monoxide and a BF_3ROH acid composition to form a product composition;

(b) adding ROH to the product composition of (a); and

(c) separating a BF_3ROH acid product from the ester, wherein ROH is selected from methanol; n-propanol; 2-propanol; n-butanol; 2-ethyl hexanol; isohexanol; isoheptanol; isooctanol; isononanol; 3,5,5-trimethyl hexanol; isodecanol; isotridecanol; 1-octanol; 1-decanol; 1-dodecanol; 1-tetradecanol and mixtures thereof and wherein the molar equivalents of ROH in the BF_3 ROH, ranges from about 2 to about 4.

37. (Previously Presented) A method of making an ester comprising:

(a) contacting an ether with carbon monoxide and a BF_32ROH acid composition to form a product composition;

(b) adding ROH to the product composition of (a); and

(c) separating a BF_32ROH acid product from the ester, wherein ROH is selected from methanol; n-propanol; n-butanol; 2-propanol 2-ethyl hexanol; isohexanol; isoheptanol; isooctanol; isononanol; 3,5 ,5-trimethyl hexanol; isodecanol; isotridecanol; 1-octanol; 1-decanol; 1-dodecanol; 1-tetradecanol and mixtures thereof.

38. (Previously Presented) The method of claim 37 further comprising recycling a portion of the separated acid product to contact the ether.

39. (Previously Presented) The method of claim 37 wherein the ether is represented by the formula R'-O-R", wherein R'= saturated C_1-C_{13} alkyl and R"= saturated C_1-C_{13} alkyl, and R' and R" can be the same or different.

40. (Previously Presented) The method of claim 37 wherein the ether is methyl-t-butylether.

41. (Previously Presented) The method of claim 37 wherein the ether is contacted with carbon monoxide and a $BF_3$2ROH acid composition at a temperature from about 60°C to about 200°C.

42. (Previously Presented) The method of claim 41 wherein said temperature is from about 110°C to about 160°C.

43. (Previously Presented) The method of claim 37 wherein the ether is contacted with carbon monoxide and a $BF_3$2ROH acid composition at a pressure from about 30 atm to about 200 atm.

44. (Previously Presented) The method of claim 43 wherein said pressure is from about 110 atm to about 160 atm.

45. (Cancelled)

46. (Previously Presented) The method of claim 37 wherein ROH is methanol.

47. (Previously Presented) The method of claim 37 wherein the ether is methyl-t-butyl ether.

48. (Previously Presented) The method of claim 37 wherein the ether is diisopropyl ether and ROH is 2-propanol.

49. (Previously Presented) The method of claim 37 further comprising contacting the ether with a saturated linear or branched hydrocarbon having at least six carbons.

50. (Previously Presented) The method of claim 37 further comprising adding to the product composition a saturated linear or branched hydrocarbon having at least six carbons.

51. (Previously Presented) The method of claim 50 further comprising separating the hydrocarbon and ROH from $BF_3$2ROH and directing a portion of the separated hydrocarbon and the separated ROH to a unit selected from the group consisting of a separation unit, a reaction unit, and a combination thereof.

52. (Previously Presented) The method of claim 37 further comprising contacting the ether with phosphoric acid.

53. (Previously Presented) The method of claim 37 wherein the acid product is separated by concentrating the acid product such that the molar ratio ROH:BF_3 in the concentrated acid product is from about 2:1 to about 4:1.

54. (Previously Presented) The method of claim 53 wherein said molar ratio of ROH:BF_3 is from about 2:1 to about 3:1.

55. (Previously Presented) The method of claim 37 wherein the acid composition has a molar ratio of ROH:BF_3 from about 1.6:1 to about 3: 1.

56. (Previously Presented) The method of claim 55 wherein said molar ratio of ROH:BF_3 is from about 1.9:1 to about 3: 1.

57. (Previously Presented) The method of claim 37 wherein the product composition contains less than 3% by weight carboxylic acid.

58. (Previously Presented) A method of making an ester comprising:

(a) contacting an ether with carbon monoxide and a BF_3 ROH acid composition to form a product composition;

(b) adding ROH to the product composition of (a); and

(c) separating a BF_3ROH acid product from the ester, wherein ROH is selected from methanol; n-propanol; n-butanol; 2-butanol 2-ethyl hexanol; isohexanol; isoheptanol; isooctanol;

isononanol; 3,5,5-trimethyl hexanol; isodecanol; isotridecanol; 1-octanol; 1 -decanol; 1 -dodecanol; 1 -tetradecanol and mixtures thereof and wherein the molar equivalents of ROH in the BF_3 ROH, ranges from about 2 to about 4.